

# Wood ducks of the Savannah River Site:

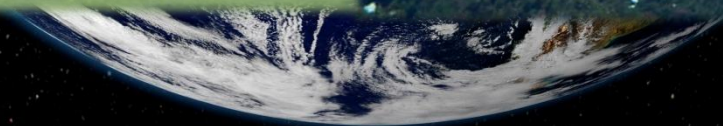
indicators of changing environments

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*Savannah River Ecology Laboratory*









# EXTREME WEATHER AND CLIMATE CHANGE IN THE AMERICAN MIND

SEPTEMBER 2012

YALE PROJECT ON CLIMATE CHANGE COMMUNICATION

GEORGE MASON UNIVERSITY CENTER FOR CLIMATE CHANGE COMMUNICATION





Today, we'll examine:

I. Global-scale climatic pattern influences on our wetland conditions.

II. The relationship between local weather patterns and wetland conditions.

III. Wetland condition impacts on Wood Duck breeding performance.

IV. Timing of Wood Duck breeding: long-term patterns and how adjustments are made.



# "The Green Emerald"

Savannah River Site

*Georgia*

*South Carolina*

Savannah River  
Floodplain



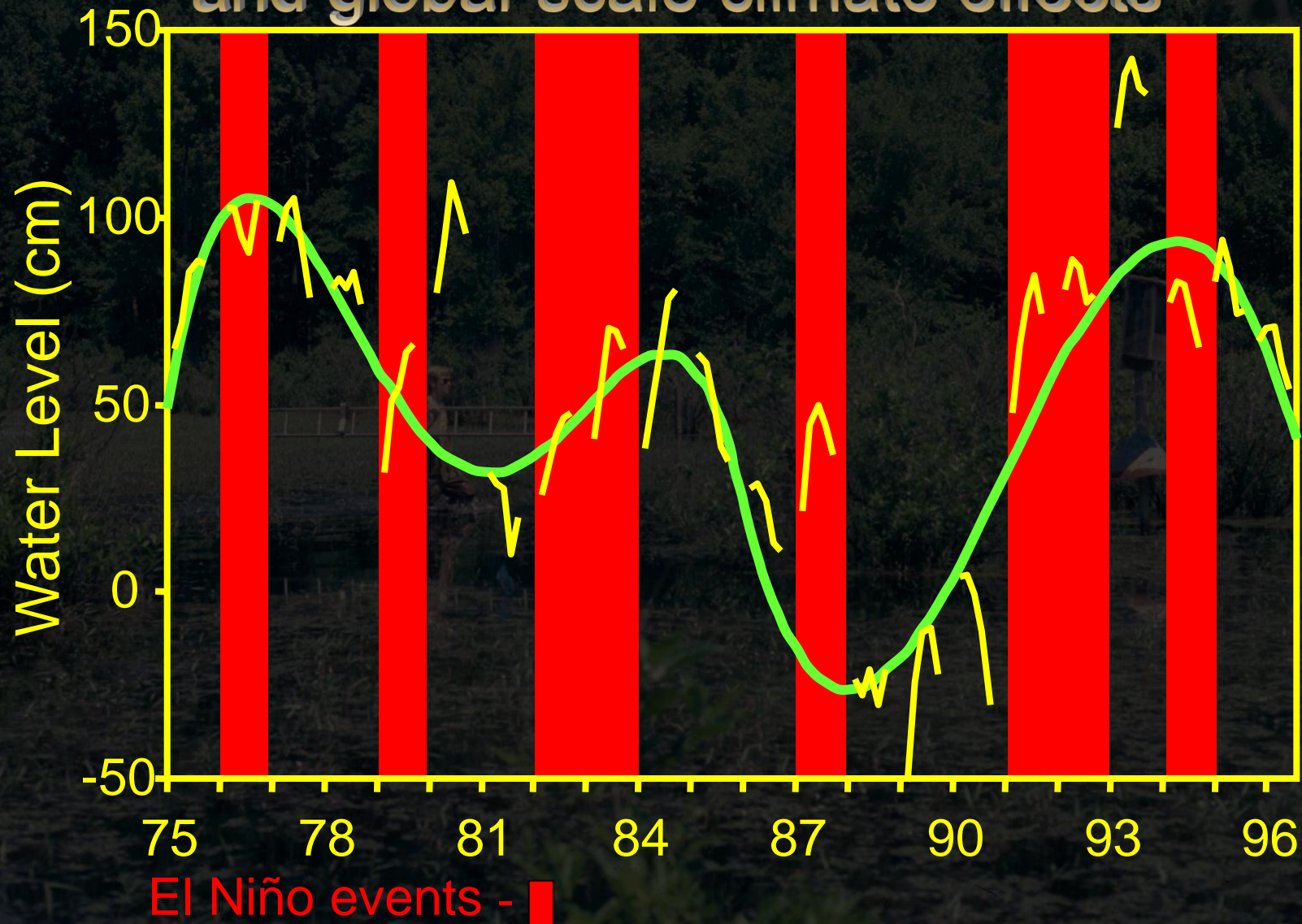


# I. Global-scale climate influences and local wetland conditions



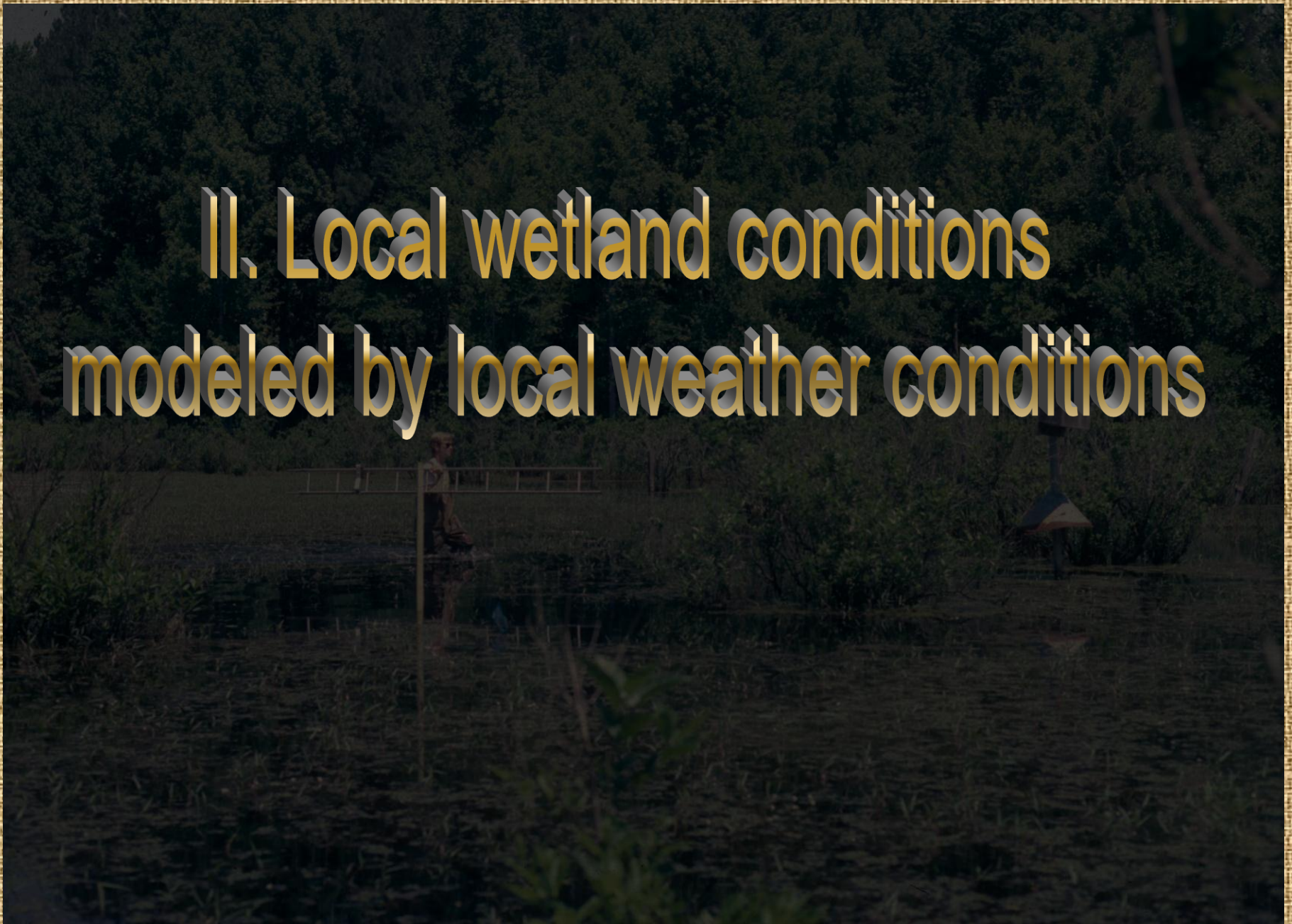


# Ellenton Bay water level patterns and global-scale climate effects





## II. Local wetland conditions modeled by local weather conditions





# Relative water level ranks describing SRS wetland conditions

## Nest-box line (wetland)

Year										Sum of ranks	
	A	B	C	D	E	F	G	H	I		
1984	12	9	10	7	11	8	10.5	11	10	88.5	wet
1985	4	6	5	6	3	6	4	3	3	40.0	dry
1986	2	1	1	4	3	3	1	4	4	23.0	dry
1987	11	10	9	5	10	10	6	8	9	78.0	normal
1988	1	2	3	1	3	1	2	1	2	16.0	dry
1989	6	5	2	2	3	2	3	2	1	26.0	dry
1990	5	3	4	3	3	4	9	5	5	41.0	dry
1991	13	11	12	9	12	13	10.5	12	13	105.5	wet
1992	8	8	8	12	8	9	5	9	12	79.0	wet
1993	10	13	13	13	13	12	12	13	11	110.0	wet
1994	7	7	6	11	7	7	7	7	7.5	66.5	normal
1995	9	12	11	10	9	11	8	10	6	86.0	wet
1996	3	4	7	8	6	5	13	6	7.5	59.5	normal

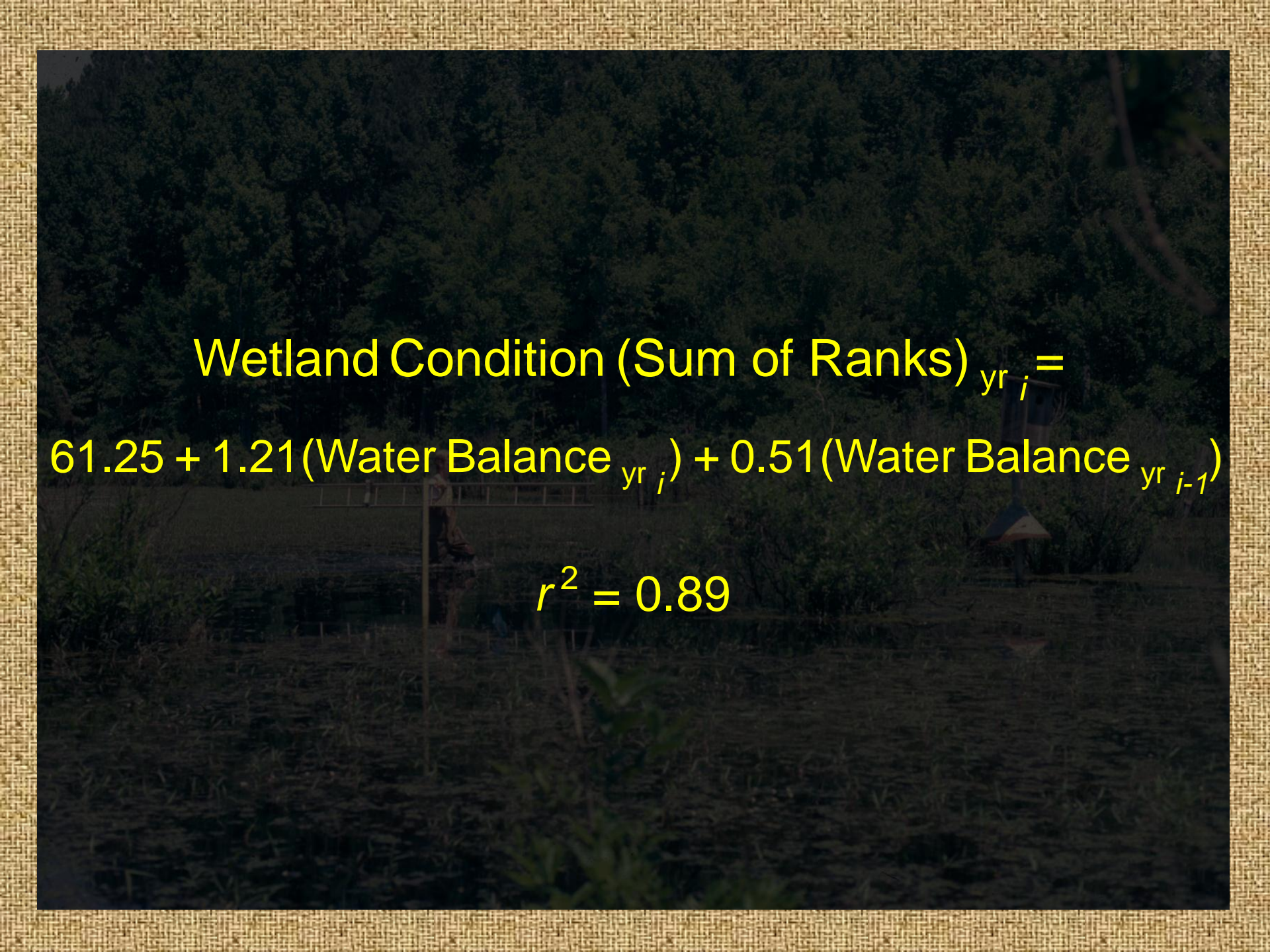


The background of the slide is a photograph of a dense forest. A person is visible in the middle ground, standing on a wooden bridge or walkway that spans a small stream or clearing. The trees are tall and leafy, creating a lush green environment. The lighting is soft, suggesting a slightly overcast day.
$$\text{Water Balance}_{\text{yr } i} = \text{Cum. Rainfall}_{\text{yr } i} - \text{Cum. Evap.}_{\text{yr } i}$$

$$\text{Cumulative Rainfall}_{\text{yr } i} = \sum \text{Oct}_{\text{yr } i-1} \dots \text{May}_{\text{yr } i}$$

$$\text{Cumulative Evaporation}_{\text{yr } i} = \sum \text{Feb}_{\text{yr } i} \dots \text{Jun}_{\text{yr } i}$$





Wetland Condition (Sum of Ranks)<sub>yr i</sub> =  
61.25 + 1.21(Water Balance<sub>yr i</sub>) + 0.51(Water Balance<sub>yr i-1</sub>)

$$r^2 = 0.89$$



# III. Wetland conditions and Wood Duck breeding performance

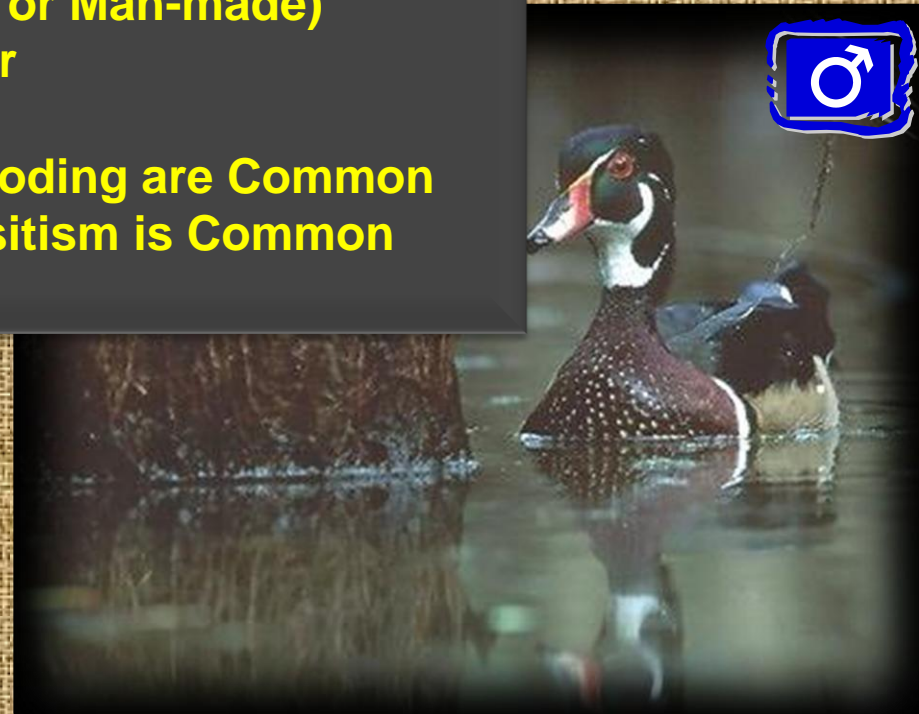






## Wood Duck General Breeding Biology

- Nest in Cavities (Natural or Man-made)
- Can Mature Within 1 Year
- Female Only Incubation
- Renesting & Double-Brooding are Common
- Intra-Specific Nest Parasitism is Common









# Variation in Wood Duck clutch size

Source of variation	<i>F</i>	df	<i>P</i>	<i>R</i> <sup>2</sup>
Overall model	6.94	21, 178	0.0001	0.45
Nest date <sup>a</sup>			0.0001	
Female mass			0.002	
Age class <sup>b</sup>			NS	
Wetland condition <sup>c</sup>			NS	
Year(Wetland cond.)			NS	
Nest date x Wetland cond.			0.014	
Nest date x Year(Wetland cond.)			NS	

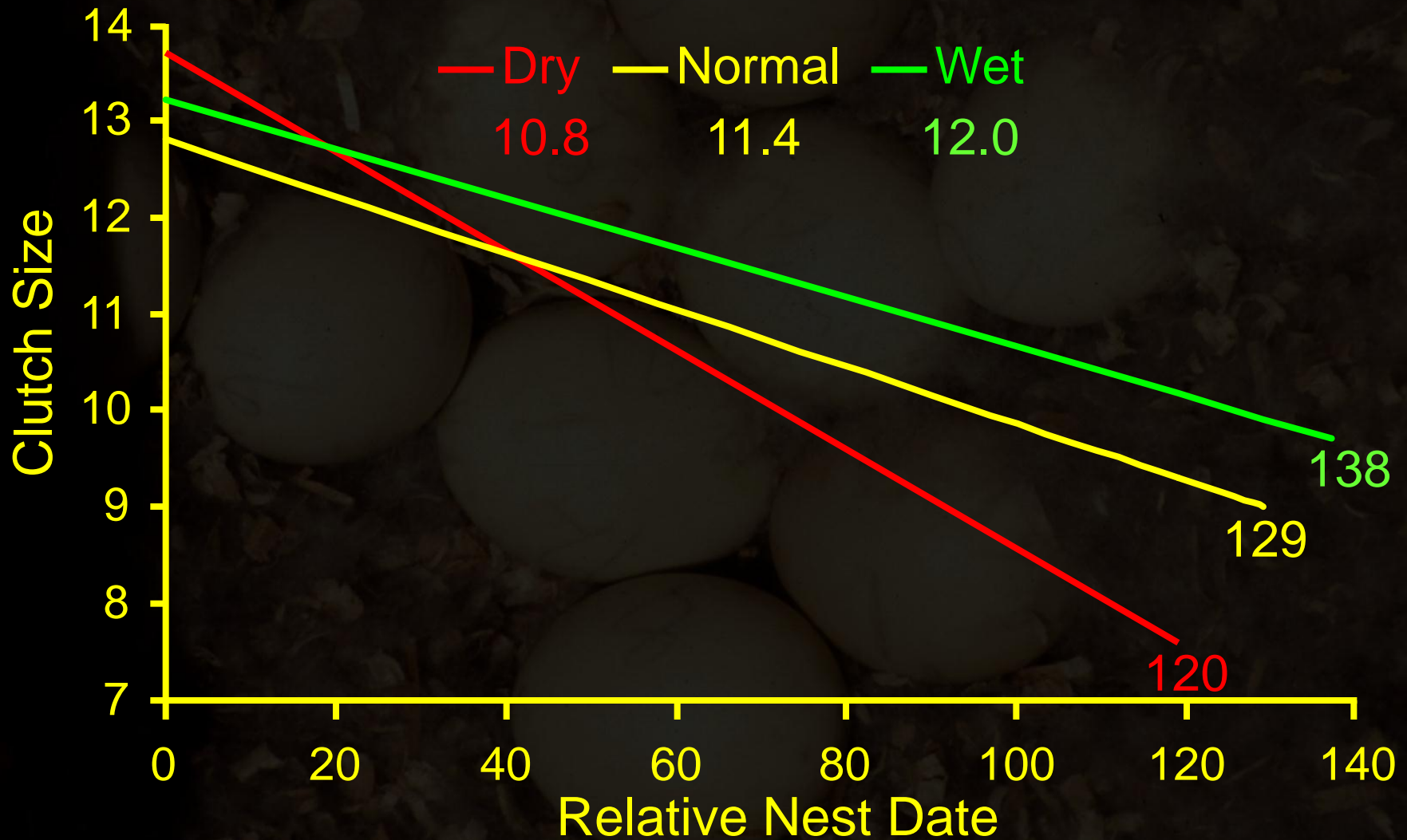
<sup>a</sup>Relative to the first nest of each year.

<sup>b</sup>Yearlings vs. older adults.

<sup>c</sup>Significance of intercepts from the interaction is implied.

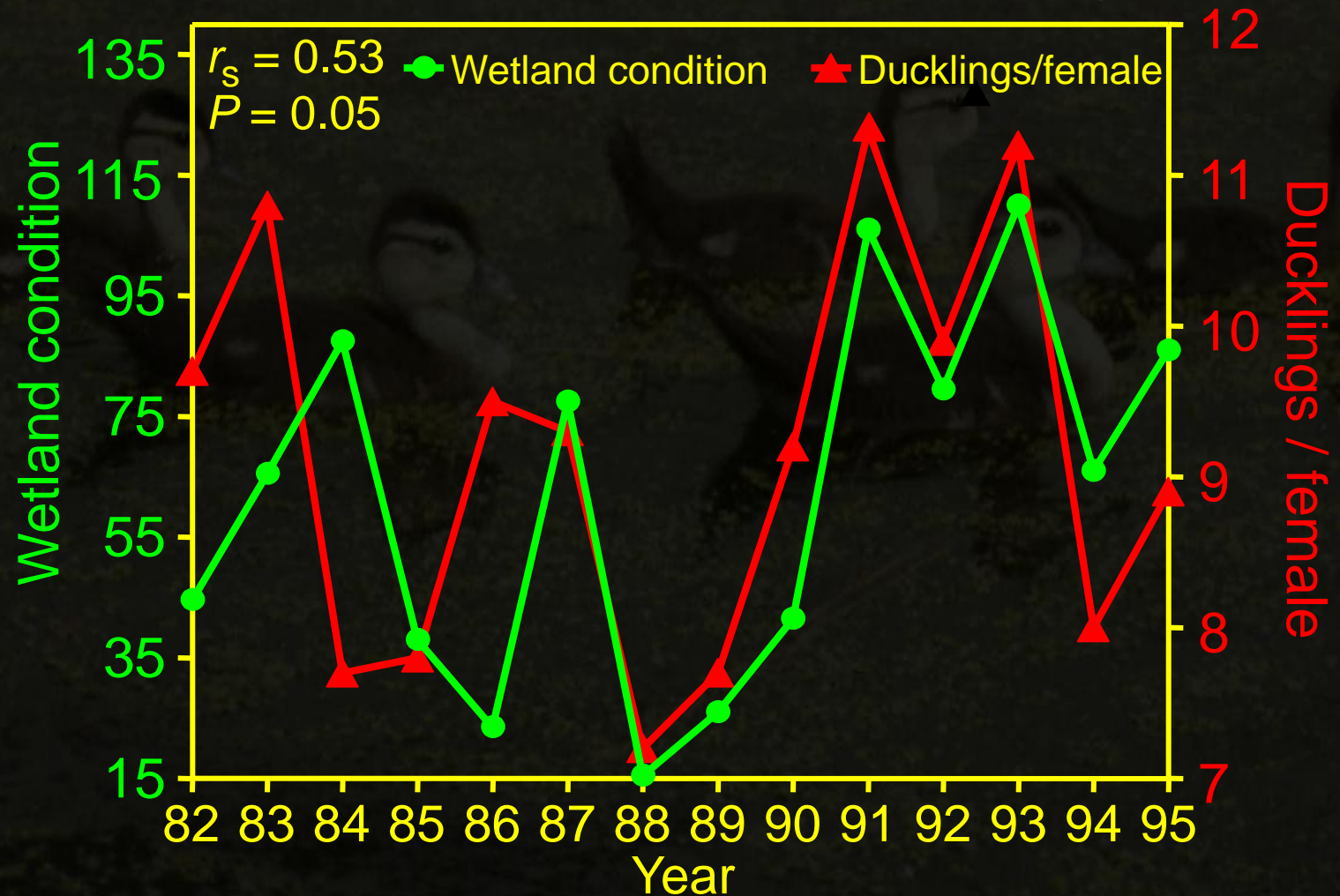


# Seasonal variation in Wood Duck clutch size relative to SRS wetland conditions



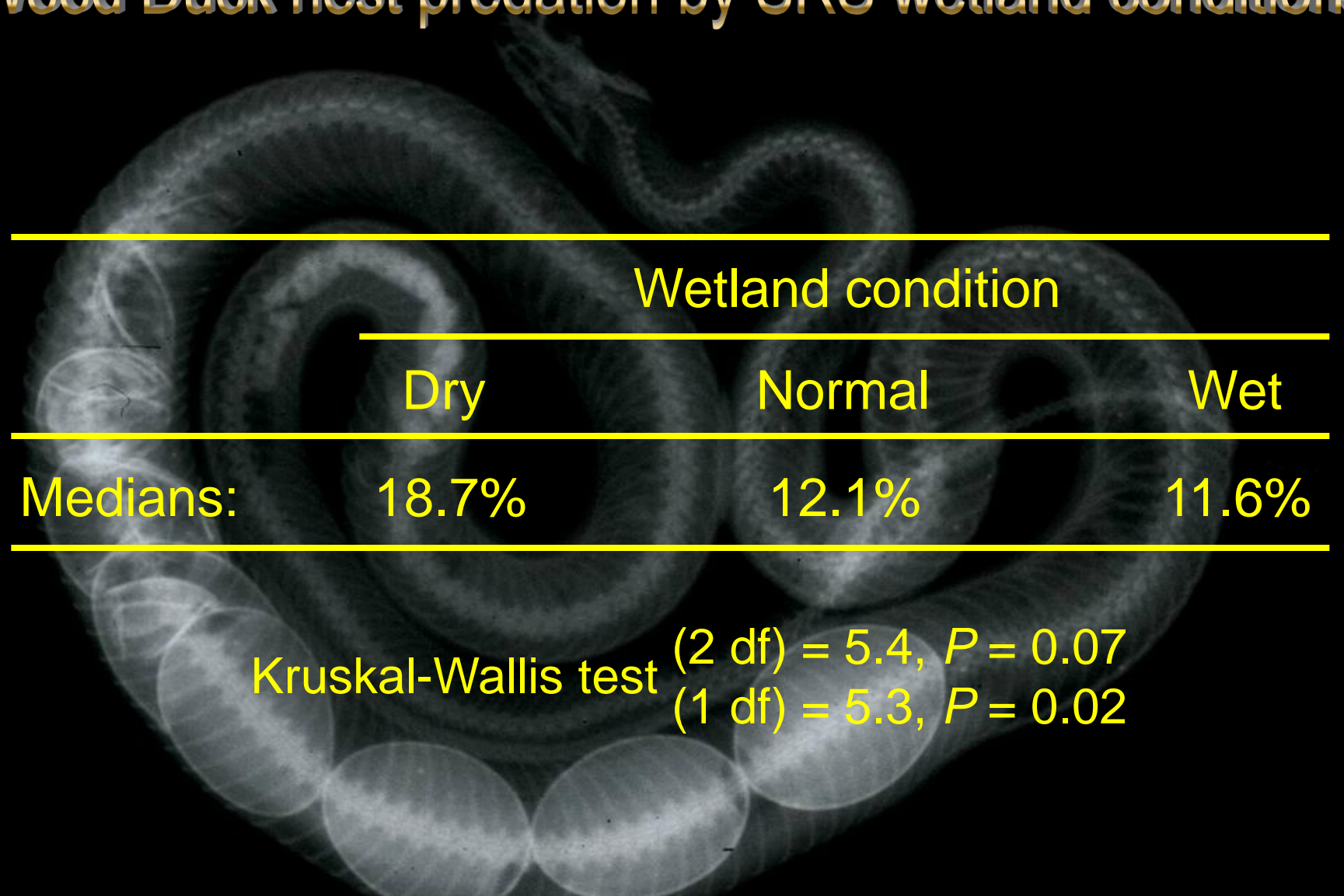


# Annual variation in SRS wetland conditions and Wood Duck productivity





# Wood Duck nest predation by SRS wetland conditions



	Wetland condition		
	Dry	Normal	Wet
Medians:	18.7%	12.1%	11.6%

Kruskal-Wallis test (2 df) = 5.4,  $P = 0.07$   
(1 df) = 5.3,  $P = 0.02$



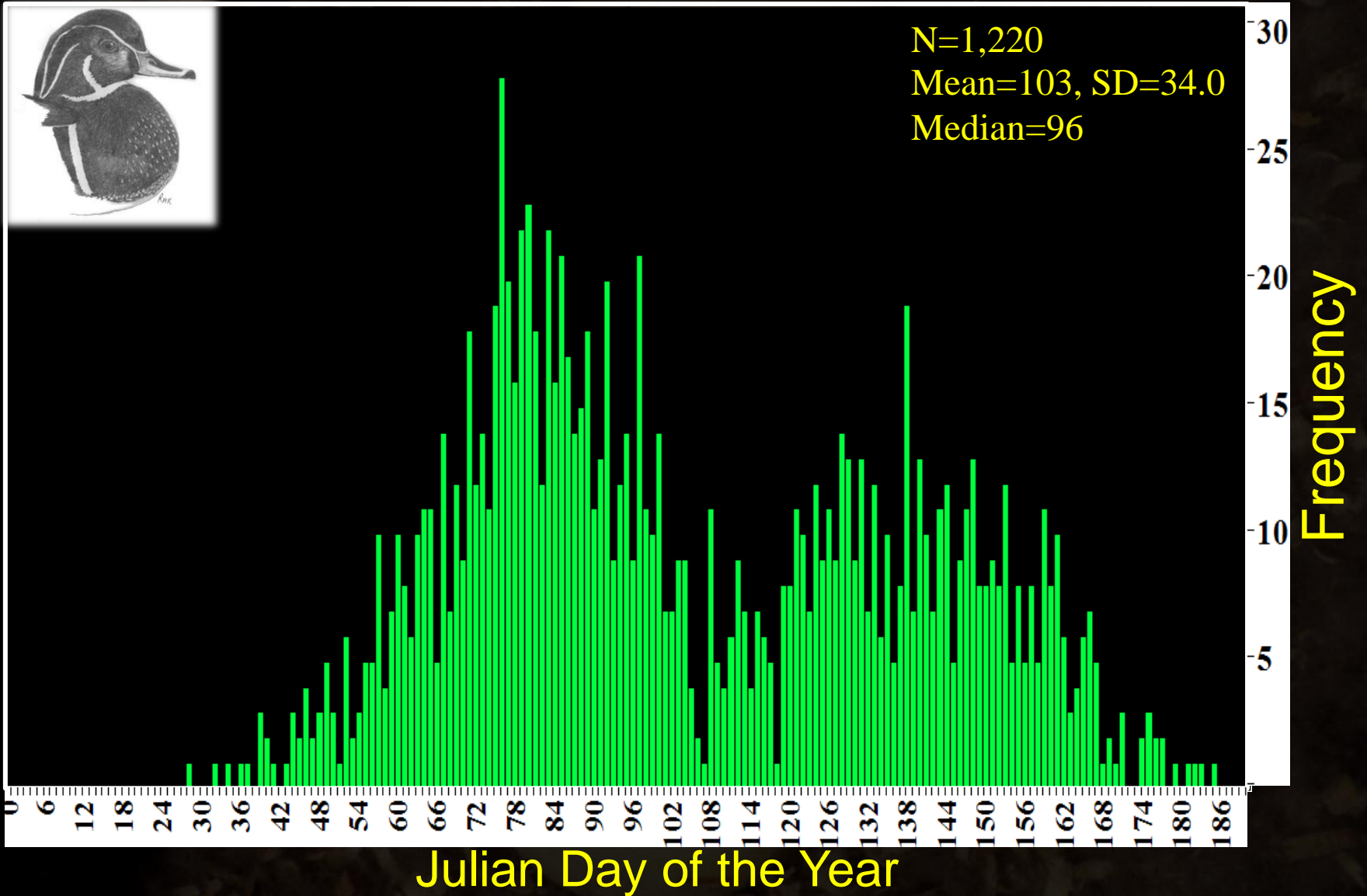
# IV. Long-term patterns in timing of Wood Duck breeding





# Permanent wetlands

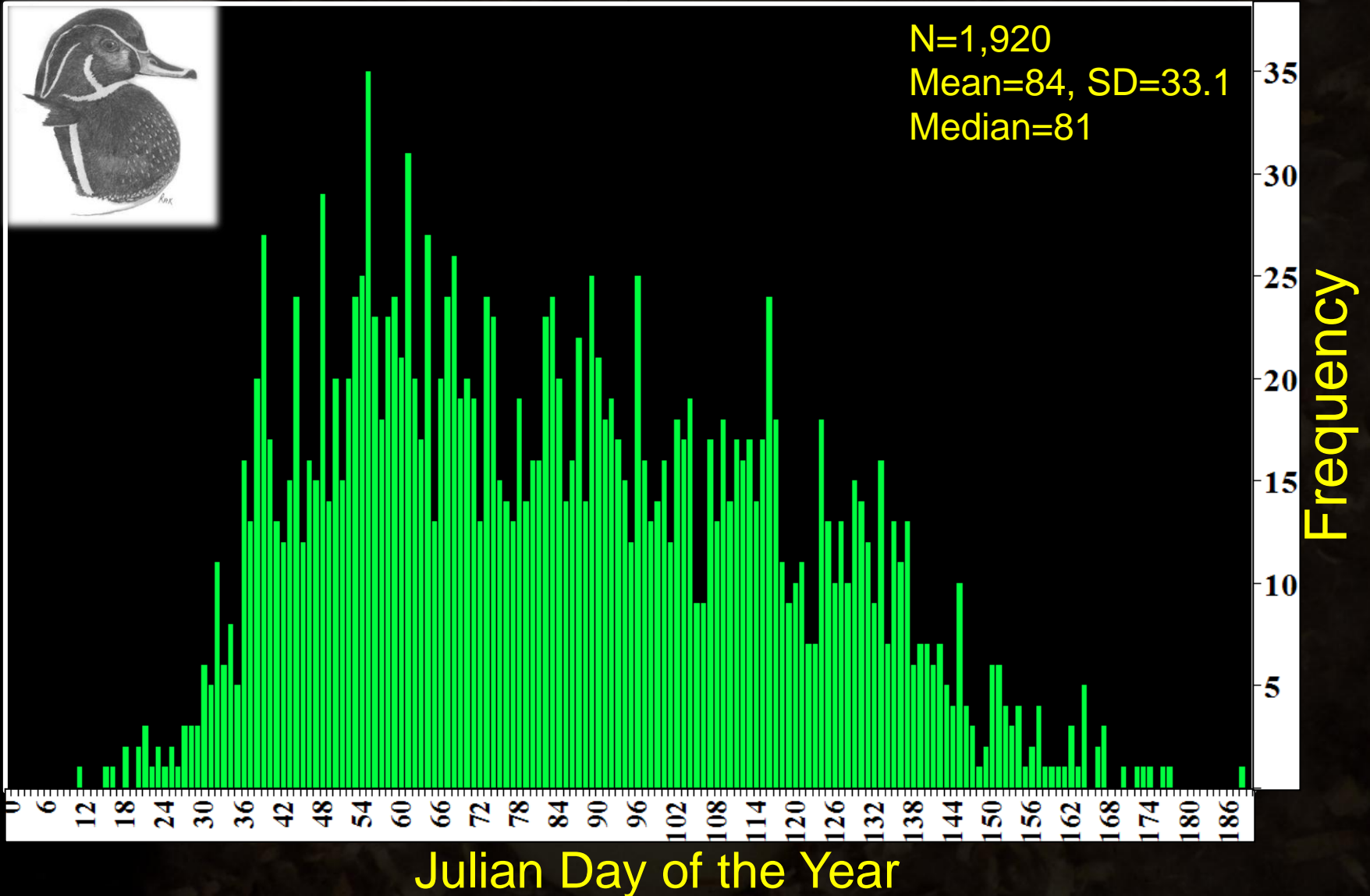
## Nest Initiation Dates





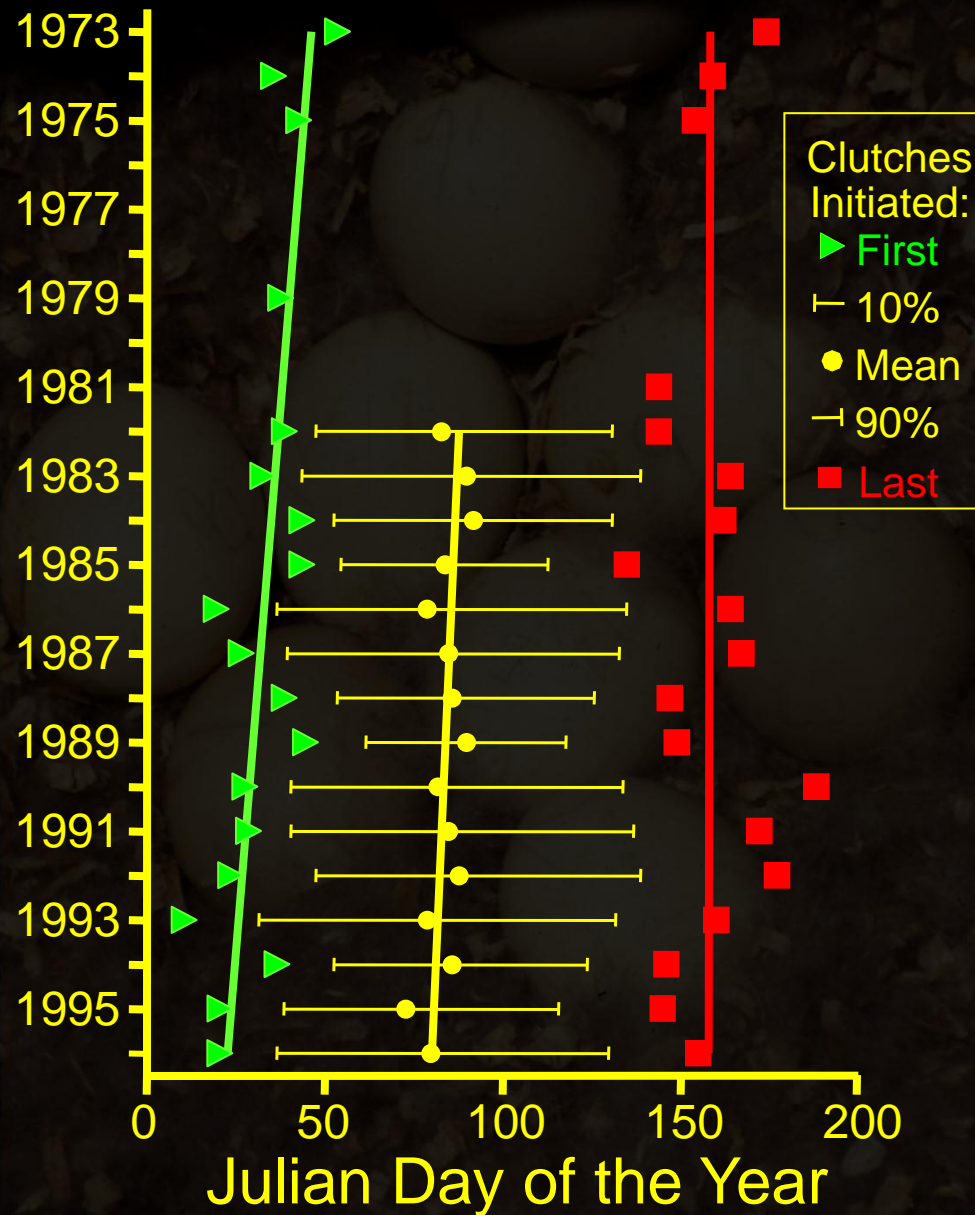
# Semi-permanent/temporary wetlands

## Nest Initiation Dates



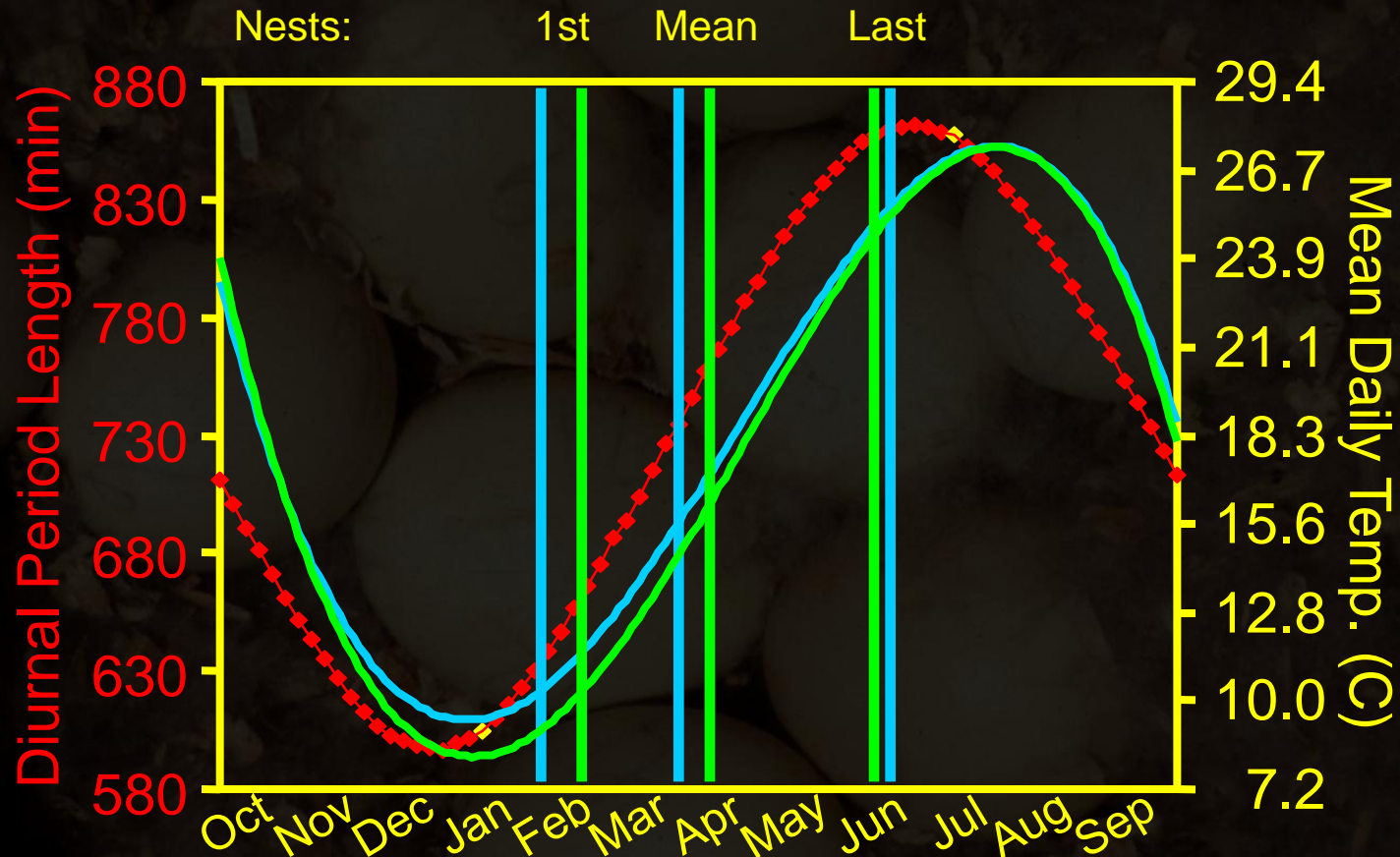


# Nest initiation dates





# Photoperiod and temperature on the SRS in relation to egg-laying dates for Wood Ducks



Green lines: data from 1980-85

Blue lines: data from 1990-95



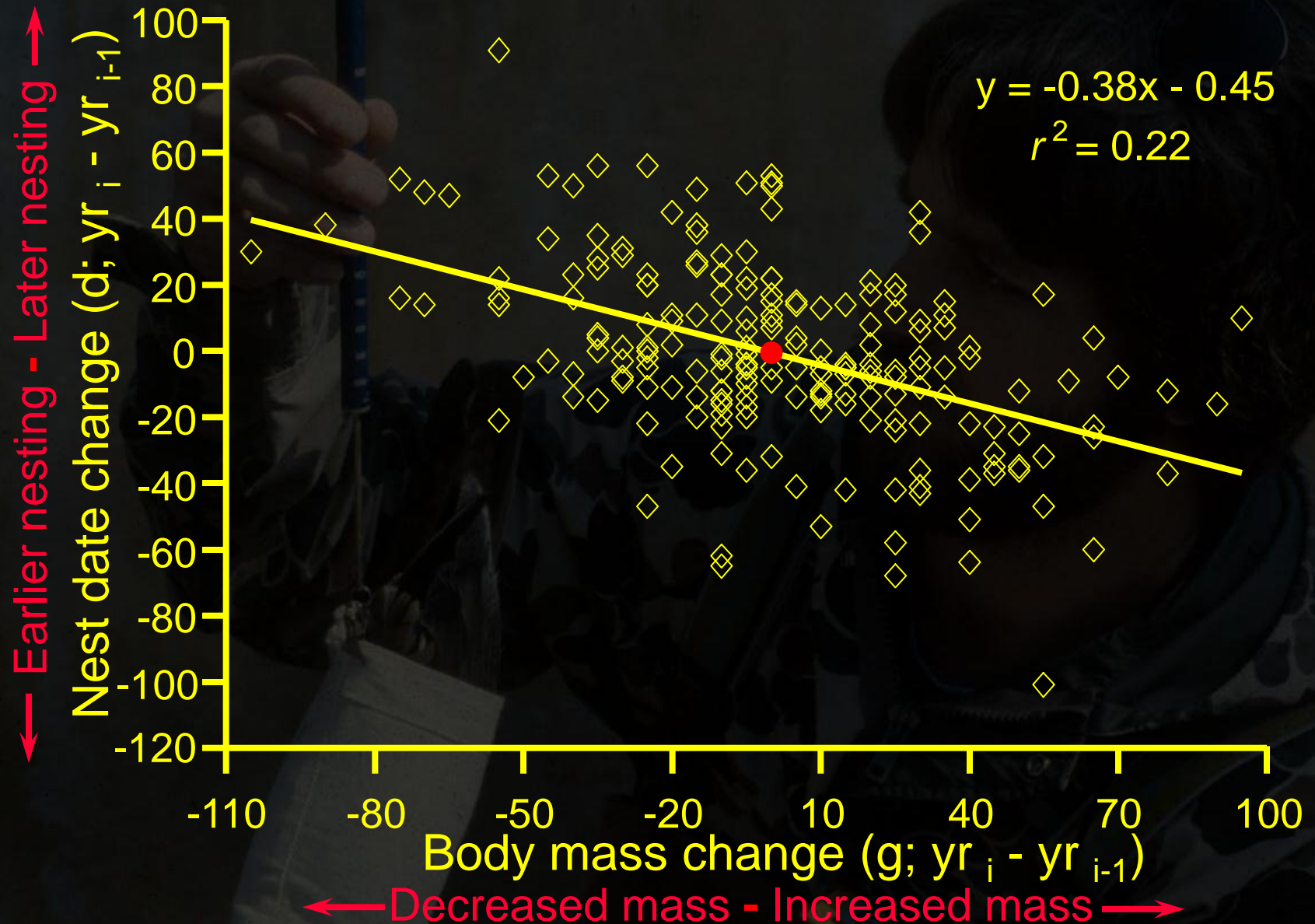
# Repeatability of Wood Duck nest date and female body mass

Realm of data	Nest date	Female body mass
All breeding events (Females, Nests) Repeatability	(287, 870) 5.9%	(234, 692) 63.2%
No first-time events (Females, Nests) Repeatability	(143, 439) 14.3%	(123, 371) 71.9%

Only females with  $\geq 2$  breeding events in different years.  
No second nest attempts within the same year.



# Wood Duck body mass and nest date trade-off



## Conclusions:

- Long-term records of wetland conditions are useful in the search for signals from large-scale climate-controlling systems.
- Wetland conditions during the wood duck breeding season can be predicted very well with models utilizing precipitation and evaporation data.
- Wetland conditions influence Wood Duck breeding performance in predictable ways.
- Wood Duck timing of reproduction changes as the ability to acquire nutrients changes.
- Existing, detailed, long-term data sets are valuable sources of information for evaluating the effects of long-term environmental change.



A fluffy duckling with dark brown and light yellow feathers is shown on the left side of the slide. It has a speech bubble coming from its beak that says "Questions?".

Questions?

### Sponsors/Participants:

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